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EXAMINER

LIANG, LEONARD S

ART UNIT PAPER NUMBER

2853

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/031,408	Applicant(s) TSUKADA ET AL.	
	Examiner Leonard S. Liang	Art Unit 2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-50 and 52-71 is/are pending in the application.
- 4a) Of the above claim(s) 2,3,5-7,12-21,24,29,30,57-61,63-67 and 71 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,8-11,22,23,25-28,31,32,36-50,52-56,62 and 68-70 is/are rejected.
- 7) ☒ Claim(s) 33-35 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 January 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3/4,12/15,11/24, 11/19 2004</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

This action is written in response to the response to election/restriction filed on 02/28/05. In the response, the applicant elected Species III without traverse. The claims that read on the elected species are claims 1, 4, 8-11, 22, 23, 25-28, 31-50, 52-56, 62, and 68-70. All other claims will be withdrawn from consideration.

Specification and Drawings

The lengthy specification and drawings have not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification and drawings. Specifically, the applicant is asked to match the reference numbers for the specification and drawings. If the applicant has done so, the examiner requests that the applicant state so in the response; the examiner will then approve the drawings in the next action.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4, 8-9, 46-48, and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694).

Kurihara et al discloses:

- {claim 1} An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops, wherein the ink consumption condition in the ink container is detected using a piezo-electric device having a piezo-electric device having a piezo-electric element during a non-recording state of the recording head, wherein the piezo-electric device further has a vibrating plate on one side of which the piezoelectric element is arranged, and a cavity forming member having a cavity which is arranged on the other side of the vibrating plate, wherein the vibrating plate can come in contact with the liquid in the liquid container via the cavity, wherein the piezo-electric element of the piezo-electric device has a vibration part (figure 1-2; Detailed Description paragraph 0001-0002, 0013)
- {claim 4} wherein the ink consumption condition in the ink container is detected using the piezo-electric device when power of the recording apparatus is turned on (inherent)
- {claim 46} A recording head configured to jet ink drops; an ink cartridge configured to feed ink to the recording head; a piezo-electric device having a piezo-electric element configured to detect an ink consumption condition in the

ink cartridge, the piezo-electric device further having a vibrating plate on one side of which the piezo-electric element is arranged, and a cavity forming member having a cavity which is arranged on the other side of the vibrating plate, the vibrating plate being able to come in contact with the liquid in the liquid container via the cavity; and a control unit for controlling the piezo-electric device so as to detect the ink consumption condition when the recording head is in a non-recording state, wherein the piezo-electric device has a vibration part (figure 1-2; Detailed Description, paragraph 0001, 0002, 0013)

- {claim 56} An ink jet recording apparatus comprising a recording head; an ink cartridge; a piezo-electric device; a control unit; the piezo-electric device has a piezo-electric element mounted on the outside of the ink cartridge, wherein the piezo-electric element of the piezo-electric device has a vibration part (abstract; figure 1-2; Detailed Description paragraph 0013)

Kurihara et al differs from the claimed invention in that it does not disclose:

- {claims 1, 46, and 56} the piezo-electric device outputs a signal indicating a residual oscillating state of the vibration part under free oscillation, and wherein the ink consumption condition is detected based on a change of the residual oscillating state of the vibration part under free oscillation corresponding to ink being consumed
- {claims 8 and 47} wherein the piezo-electric device detects changes in acoustic impedance, thereby detects the ink consumption condition in the ink container

- {claim 9 and 48} wherein the piezo-electric element of the piezo-electric device has a vibration part, wherein the piezo-electric element of the piezo-electric device detects changes in the acoustic impedance on the basis of the counter electromotive force

Anderson et al discloses:

- {claims 1, 46, and 56} the piezo-electric device outputs a signal indicating a residual oscillating state of the vibration part under free oscillation, and wherein the ink consumption condition is detected based on a change of the residual oscillating state of the vibration part under free oscillation corresponding to ink being consumed (column 2, lines 6-40)
- {claims 8 and 47} wherein the piezo-electric device detects changes in acoustic impedance, thereby detects the ink consumption condition in the ink container (column 7, lines 1-9)
- {claim 9 and 48} wherein the piezo-electric element of the piezo-electric device has a vibration part, wherein the piezo-electric element of the piezo-electric device detects changes in the acoustic impedance on the basis of the counter electromotive force (column 2, lines 6-40; column 7, lines 1-9)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Anderson et al into the invention of Kurihara et al. The motivation for the skilled artisan in doing so is to gain the benefit of providing measurements of fluid properties in an efficient, compact, and economical way (column 1, lines 54-59).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Matsuzaki et al (US Pat 6416152).

Kurihara et al, as modified, discloses, with respect to claim 10, an ink cartridge (figure 1); an ink consumption condition detection method (as applied to claim 1 above)

Kurihara et al, as modified, differs from the claimed invention in that it does not disclose storing information, reading information, and judging whether detection should be executed.

Matsuzaki et al discloses, with respect to claims 10, a semiconductor memory device mounted on the ink container which stores, reads, and executes (column 1, lines 27-40; detection-judging step is inherent in step where printing is executed under an optimum condition)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the semiconductor memory device disclosed by Matsuzaki et al into the invention of modified Kurihara et al so that there could be storing, reading, and judging steps. The motivation for the skilled artisan in doing so is to gain the benefit of improving the characteristics of ink and a driving signal applied to the print head (column 1, lines 27-30).

Claims 11 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Kato (US Pat 6347853).

Kurihara et al, as modified discloses:

- {claim 11} an ink consumption condition detection method (as applied to claim 1 above)
- {claim 52} an ink jet recording apparatus (as applied to claim 46 above)

Kurihara et al, as modified, differs from the claimed invention in that it does not disclose:

Art Unit: 2853

- {claim 11} ink container is an ink cartridge loaded on a carriage; reconfirming step
- {claim 52} ink cartridge and recording head are loaded on the carriage; redetecting the ink consumption condition in the ink cartridge after the piezo-electric device detects absence of ink in the ink cartridge when the recording head is in a non-recording state.

Kato discloses:

- {claim 11} ink container is an ink cartridge loaded on a carriage (column 1, lines 21-25); reconfirming step (column 2, lines 1-5)
- {claim 52} ink cartridge and recording head are loaded on the carriage (column 1, lines 61-67); redetecting the ink consumption condition in the ink cartridge after the piezo-electric device detects absence of ink in the ink cartridge when the recording head is in a non-recording state (column 2, lines 1-5)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Kato into the invention of modified Kurihara et al so that the ink container is an ink cartridge loaded on a carriage; the ink cartridge is detected during a period in which the carriage is stopped; the ink cartridge is detected after a predetermined time lapses from the beginning of a stop state of the carriage; the ink container is an ink cartridge loaded on a carriage; there is a reconfirming step; the ink cartridge and recording head are loaded on the carriage; redetecting the ink consumption condition in the ink cartridge after the piezo-electric device detects absence of ink in the ink cartridge when the recording head is in a non-recording state. The motivation for the skilled artisan in having the ink container on the carriage and stopping the carriage is to gain the benefit of being able to move the ink cartridge to a detection position (column 1, lines 21-25). The motivation for the skilled artisan in having a reconfirming/redetecting step is to gain the benefit of minimizing erroneous ink level determinations (column 2, lines 12-15).

Claims 22-23, 25-28, and 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Hoisington et al (US Pat 5694156).

Kurihara et al, as modified, discloses, with respect to claims 22-32, an ink consumption condition detection method (as applied to claim 1 above).

Kurihara et al, as modified, differs from the claimed invention in that it does not disclose:

- {claim 22} measuring timing of the ink consumption condition is controlled on the basis of an operation history of the ink jet recording apparatus
- {claim 23} measuring frequency is increased according to cumulation of operations of the ink jet recording apparatus
- {claim 25} a measurement of the ink consumption condition is executed immediately when the measuring timing of the ink consumption condition comes after a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last
- {claim 26} the measuring timing comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, measurement is executed immediately after the predetermined time elapses
- {claim 27} the measuring timing of the ink consumption condition comes after a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is shortened
- {claim 28} the measuring timing of the ink consumption condition comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is increased

Art Unit: 2853

- {claim 31} a history memory installed in the ink jet recording apparatus or the ink container stores at least one of a cumulative time of operations of the ink jet recording apparatus and a cumulative measuring count
- {claim 32} history memory further stores past measurement histories

Hoisington et al teaches:

- {claim 22} measuring timing of the ink consumption condition is controlled on the basis of an operation history of the ink jet recording apparatus (column 3, lines 20-30)
- {claim 23} measuring frequency is increased according to cumulation of operations of the ink jet recording apparatus (column 3, lines 20-30; column 1, lines 61-65; it is inherent to the invention that the measuring frequency depends on the cumulation of operations)
- {claim 25} a measurement of the ink consumption condition is executed immediately when the measuring timing of the ink consumption condition comes after a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last (column 3, lines 8-30)
- {claim 26} the measuring timing comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, measurement is executed immediately after the predetermined time elapses (column 3, lines 8-30)
- {claim 27} the measuring timing of the ink consumption condition comes after a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is shortened (column 3, lines 8-30; it is inherent to the invention that the measuring timing depends on the predetermined time, so if the measuring timing of the ink consumption condition comes after a

predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is shortened)

- {claim 28} the measuring timing of the ink consumption condition comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is increased (column 3, lines 8-30; it is inherent to the invention that the measuring timing depends on the predetermined time, so if the measuring timing of the ink consumption condition comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is increased)
- {claim 31} a history memory installed in the ink jet recording apparatus or the ink container stores at least one of a cumulative time of operations of the ink jet recording apparatus and a cumulative measuring count (figure 2, reference 31; column 3, lines 8-30)

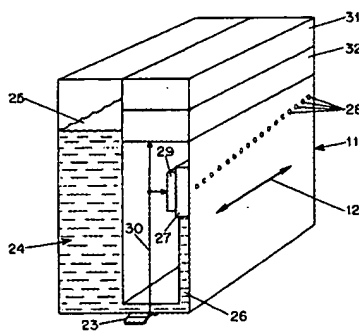


FIG. 2

- {claim 32} history memory further stores past measurement histories

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Hoisington et al into the invention of modified Kurihara et al so that measuring timing of the ink consumption condition is controlled on the basis of an operation history of the ink jet recording apparatus; measuring frequency is increased according to cumulation of operations

of the ink jet recording apparatus; a measurement of the ink consumption condition is executed immediately when the measuring timing of the ink consumption condition comes after a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last; the measuring timing comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, measurement is executed immediately after the predetermined time elapses; the measuring timing of the ink consumption condition comes after a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is shortened; the measuring timing of the ink consumption condition comes before a predetermined time elapses from a point of time when a carriage on which the recording head is loaded moves last, a measuring interval is increased; a history memory installed in the ink jet recording apparatus or the ink container stores at least one of a cumulative time of operations of the ink jet recording apparatus and a cumulative measuring count; history memory further stores past measurement histories. The motivation for the skilled artisan in doing so is to gain the benefit of preventing lost images when the printhead reservoir runs low on ink and which can be refilled and reused without cumulative errors in the quantity of ink contained in the reservoir (column 1, lines 61-65).

Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Shinada et al (US Pat 5132711).

Kurihara et al, as modified, discloses, with respect to claim 36, an ink consumption condition detection method (as applied to claim 1 above).

Kurihara et al differs from the claimed invention in that it does not disclose:

- {claim 36} ink container is an ink cartridge loaded on the ink jet recording apparatus in a removal state

Shinada et al discloses:

- {claim 36} ink container is removable (figure 2, reference IJC)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Shinada et al into the invention of modified Kurihara et al so that there is a maintenance operation, a feeding/ejecting operation, and a removable ink cartridge. The motivation for the skilled artisan in having a wiping member is to gain the benefit of cleaning the print head (column 2, lines 62-64). The motivation for the skilled artisan in having a paper feed unit is to gain the benefit of forming a desired image on a recording surface (column 2, lines 43-45). The motivation for the skilled artisan in having a removable ink container is to gain the benefit of being able to switch cartridges when one runs out of ink, which is disadvantageous (column 1, lines 30-35).

Claims 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Fumiyuki (JP Pat 10323997).

Kurihara et al, as modified discloses, with respect to claims 4 and 37-42, an ink consumption condition detection method (as taught in claim 1).

Kurihara et al, as modified, differs from the claimed invention in that it does not disclose:

- {claim 37} consumption condition calculation process
- {claim 38} ink level is detected based on either a calculated result information of the ink consumption condition in the ink container calculated by the consumption condition calculation process or a measured result information of the ink consumption condition in the ink container measured by the piezo-electric device

Art Unit: 2853

- {claim 39} when an ink residue on the ink level reaches a predetermined ink residue, the ink jet recording apparatus performs a peripheral operation in accordance with the ink residue
- {claim 40} the predetermined ink residue is an ink residue set as ink end, and, when the ink end is detected, the ink jet recording apparatus performs a low ink processing operation
- {claim 41} the ink consumption condition is not measured by the piezo-electric device until the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level

Fumiyuki discloses:

- {claim 37} consumption condition calculation process (Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2)
- {claim 38} ink level is detected based on either a calculated result information of the ink consumption condition in the ink container calculated by the consumption condition calculation process or a measured result information of the ink consumption condition in the ink container measured by the piezo-electric device (Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2)
- {claim 39} when an ink residue on the ink level reaches a predetermined ink residue, the ink jet recording apparatus performs a peripheral operation in accordance with the ink residue (Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2)
- {claim 40} the predetermined ink residue is an ink residue set as ink end, and, when the ink end is detected, the ink jet recording apparatus performs a low ink processing operation (Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2)

- {claim 41} the ink consumption condition is not measured by the piezo-electric device until the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level (Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Fumiyuki into the invention of modified Kurihara et al so that the ink condition is detected when power of recording apparatus is turned on/off; there is a consumption condition calculation process; ink level is detected based on either a calculated result information of the ink consumption condition in the ink container calculated by the consumption condition calculation process or a measured result information of the ink consumption condition in the ink container measured by the piezo-electric device; when an ink residue on the ink level reaches a predetermined ink residue, the ink jet recording apparatus performs a peripheral operation in accordance with the ink residue; the predetermined ink residue is an ink residue set as ink end, and, when the ink end is detected, the ink jet recording apparatus performs a low ink processing operation; the ink consumption condition is not measured by the piezo-electric device until the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level. The motivation for the skilled artisan in doing so is to gain the benefits of being able to detect during power-on (as was taught above to be common), and to detect and judge an amount of ink residue (abstract; Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2).

Claims 42 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claims 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694) and Fumiyaki (JP Pat 10323997), as applied in claim 37 above, and further in view of Hoisington et al (US Pat 5694156).

Kurihara et al, as modified, teaches all limitations of the claimed invention except for the following:

- {claim 42} the measuring frequency of the ink consumption condition by the piezo-electric device is lowered until the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level
- {claim 43} the measuring frequency of the ink consumption condition by the piezo-electric device is increased after the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level.

Hoisington et al discloses:

- {claim 42} measuring frequency is related to the number of detected drops ejected (column 3, lines 20-30; thus when more drops are ejected, measuring frequency is increased. As taught above in Fumiyaki, most of the drops are not ejected until after the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level. Thus, it is inherent to the invention that the measuring frequency of the ink consumption condition by the piezo-electric device is lowered until the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level).
- {claim 43} measuring frequency is related to the number of detected drops ejected (column 3, lines 20-30; thus when more drops are ejected, measuring frequency is increased. As taught above in Fumiyaki, most of the drops are not ejected until after the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level. Thus, it is inherent to the invention that the measuring

frequency of the ink consumption condition by the piezo-electric device is increased after the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Hoisington et al into the invention of modified Kurihara et al so that the measuring frequency of the ink consumption condition by the piezo-electric device is lowered until the ink residue calculated by the consumption condition calculation process reaches an amount in a neighborhood of the measuring position level; the measuring frequency of the ink consumption condition by the piezo-electric device is increased after the ink residue calculated by the consumption condition calculation process. The motivation for the skilled artisan in doing so is to gain the benefit of preventing lost images when the printhead reservoir runs low on ink and which can be refilled and reused without cumulative errors in the quantity of ink contained in the reservoir (column 1, lines 61-65).

Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Fumiyuki (JP Pat 10323997) and Bullock et al (US Pat 5835817).

Kurihara et al, as modified, discloses, with respect to claim 44, an ink consumption condition detection process (as taught in claim 1).

Kurihara et al, as modified differs from the claimed invention in that it does not disclose a consumption condition calculation process; ink end or no-end is decided based on a average of a plurality of measured results of the ink consumption condition measured by the piezo-electric device.

Fumiyuki discloses, with respect to claim 44, a consumption condition calculation process (as taught in claim 37).

Bullock et al discloses, with respect to claim 44, ink end or no-end is based on a average of measured results (column 7, lines 37-63).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Fumiyuki into the invention of modified Kurihara et al so that there is a consumption condition calculation process. The motivation for the skilled artisan in doing so is to gain the benefits of being able to detect during power-on (as was taught above to be common), and to detect and judge an amount of ink residue (abstract; Detailed Description page 2, lines 45-51; Detailed Description page 3, lines 1-2).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Bullock et al into the invention of modified Kurihara et al so that ink end or no-end is based on a average of measured results. The motivation for the skilled artisan in doing so is to gain the benefit of being able to store usage information for the printer (column 7, lines 61-63).

Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), Fumiyaki (JP Pat 10323997), and Bullock et al (US Pat 5835817), as applied to claim 44 above, and further in view of Hoisington et al (US Pat 5694156).

Kurihara et al, as modified, teaches all limitations of the claimed invention except for the following: the measuring frequency of the piezo-electric device is lowered until the first passing of the ink level through the measuring position level is measured by the piezo-electric device.

Hoisington et al discloses, with respect to claim 45, that measuring frequency is related to the number of detected drops ejected (column 3, lines 20-30; thus when more drops are ejected, measuring frequency is increased. As taught above in Fumiyaki, most of the drops are not ejected until after the consumption condition calculation process reaches an amount in a neighborhood of the measuring

Art Unit: 2853

position level. Thus, it is inherent to the invention that the measuring frequency of the piezo-electric device is lowered until first passing of the ink level through the measuring position level is measured by the piezo-electric device).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Hoisington et al into the invention of modified Kurihara et al, so that the measuring frequency of the piezo-electric device is lowered until the first passing of the ink level through the measuring position level is measured by the piezo-electric device. The motivation for the skilled artisan in doing so is to gain the benefit of preventing lost images when the printhead reservoir runs low on ink and which can be refilled and reused without cumulative errors in the quantity of ink contained in the reservoir (column 1, lines 61-65).

Claims 49-50 and 55 are rejected under 35 U.S.C. 102(b) as being anticipated by Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Ujita et al (US Pat 5506611).

Kurihara et al discloses, with respect to claims 49-50, an ink jet recording apparatus (as applied to claim 46 above).

Kurihara et al differs from the claimed invention in that it does not disclose:

- {claim 49} a storage unit of storing the ink consumption condition in the ink cartridge which is detected by the piezo-electric device
- {claims 50 and 55} the storage unit is mounted on the ink cartridge

Ujita et al discloses:

- {claim 49} a storage unit of storing the ink consumption condition in the ink cartridge which is detected by the piezo-electric device (figure 10, reference 22; column 7-10)
- {claims 50 and 55} the storage unit is mounted on the ink cartridge (figure 10, reference 22; column 7-10)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Ujita et al into the invention of modified Kurihara et al. The motivation for the skilled artisan in doing so is to gain the benefit of providing an ink cartridge to which is imparted information for controlling the driving conditions of a recording head on the basis of the ink used (column 7, lines 6-10).

Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694) and Kato (US Pat 6347853), as applied to claim 52, and further in view of Nakano et al (JP Pat 11010909).

Kurihara et al, as modified, discloses controlling the piezo-electric device so as to redetect the ink consumption condition in the ink cartridge in predetermined timing (as applied to claim 52).

Kurihara et al, as modified, differs from the claimed invention in that it does not disclose the control unit moves the carriage after detection of absence of ink in the ink cartridge by the piezo-electric device.

Nakano et al (JP Pat 11010909) discloses the control unit moves the carriage after detection of absence of ink in the ink cartridge by the piezo-electric device.

Art Unit: 2853

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Nakano et al (JP Pat 11010909) into the invention of modified Kurihara et al. The motivation for the skilled artisan in doing so is to gain the benefit of being able to print with the residual ink in the cartridge, even when detection means state that the cartridge is empty (Detailed Description, paragraph 0067).

Claims 54 and 62 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), Kato (US Pat 6347853), and Nakano et al (JP Pat 11010909), as applied to claim 53, and further in view of Furukawa (US Pat 4337470).

Kurihara et al, as modified, teaches all limitations of the claimed invention except for the following: a shock unit giving a shock to the ink cartridge during movement of the carriage.

Furukawa discloses, with respect to claims 54 and 62, a shock unit giving a shock to the ink cartridge during movement of the carriage (figure 2, reference 18; column 1, lines 31-48; vibrator serves as shock unit).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Furukawa into the invention of modified Kurihara et al. The motivation for the skilled artisan in doing so is to gain the benefit of oscillation to the ink, thus causing ejection from the head (column 1, lines 30-35).

Art Unit: 2853

Claims 68 and 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), as applied to claims 1, 4, 8-9, 46-48, and 56 above, and further in view of Ohori et al (JP Pat 57208260A).

Kurihara et al, as modified, teaches all limitations of the claimed invention except for the following: wherein the piezo-electric device has a piezo-electric layer and an electrode disposed between the piezo-electric layer and the vibrating plate.

Ohori et al discloses wherein the piezo-electric device has a piezo-electric layer and an electrode disposed between the piezo-electric layer and the vibrating plate (figure 1, reference 6-8).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Ohori et al into the invention of modified Kurihara et al. The motivation for the skilled artisan in doing so is to gain the benefit of performing accurate detection without using any complicated means for observation.

Claim 69 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kurihara et al (JP Pat 10305590) in view of Anderson et al (US Pat 6044694), Kato (US Pat 6347853), Nakano et al (JP Pat 11010909), and Furukawa (US Pat 4337470), as applied to claim 54, and further in view of Ohori et al (JP Pat 57208260A).

Kurihara et al, as modified, teaches all limitations of the claimed invention except for the following: wherein the piezo-electric device has a piezo-electric layer and an electrode disposed between the piezo-electric layer and the vibrating plate.

Ogori et al discloses wherein the piezo-electric device has a piezo-electric layer and an electrode disposed between the piezo-electric layer and the vibrating plate (figure 1, reference 6-8).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Ogori et al into the invention of modified Kurihara et al. The motivation for the skilled artisan in doing so is to gain the benefit of performing accurate detection without using any complicated means for observation.

Allowable Subject Matter

Claims 33-35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The reasons for this were discussed in a previous rejection and will not here be repeated.

Response to Arguments

Applicant's arguments with respect to claims 1, 4, 8-11, 22, 23, 25-28, 31-50, 52-56, 62, and 68-70 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonard S. Liang whose telephone number is (571) 272-2148. The examiner can normally be reached on 8:30-5 Monday-Friday.

Art Unit: 2853

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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MANISH S. SHAH
PRIMARY EXAMINER